CLINICAL EVALUATION AND PARENTAL SATISFACTION WITH PEDIATRIC POSTERIOR STAINLESS STEEL CROWNS AND ZIRCONIA CROWNS - A COMPARATIVE STUDY

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DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled **CLINICAL EVALUATION AND PARENTAL SATISFACTION WITH PEDIATRIC POSTERIOR STAINLESS STEEL CROWNS AND ZIRCONIA CROWNS – A COMPARATIVE STUDY** is a bonafide and genuine research work carried out by me under the guidance of **Dr.M.JAYATHI MDS**, Professor and Head, Department of Paedodontics and Preventive Dentistry, Ragas Dental College and Hospital, Chennai.

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CERTIFICATE

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This dissertation is submitted to **THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY**, in partial fulfillment for the degree of **Master of Dental Surgery in Branch VIII –Paedodontics and Preventive Dentistry.**

It has not been submitted (partially or fully) for the award of any other degree or diploma

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Introduction

INTRODUCTION

Early childhood caries is a global epidemic problem affecting majority of preschool children, if left untreated leads to degenerating condition in primary dentition even at very young age [1]. The mutilated teeth can be restored with full coronal restoration in order to preserve the integrity of primary dentition until their natural exfoliation which can be achieved with full coronal restoration. Till date, various preformed crowns have been tried as full coronal restorations for both therapeutic and preventive treatment[2,3,4].

Stainless steel crowns were the choice of full coronal restoration, as they were easily available as preformed, pretrimmed and pre contoured crowns with wide range of sizes and with proven clinical efficiency[5]. Stainless steel crowns, introduced by "Rocky Mountain" company were later improved by various manufacturers and they were used in restoring multi surface caries of primary and young permanent dentition, as post endodontic restoration, abutment for space maintainer and as preventive restoration for special children. Literature evidence exposes the superiority of stainless steel crowns over conventional restorations even when used as a preventive strategy for children with medical or dental developmental disability. The only disadvantage of SSC was its unesthetic appearance[6,7].

A survey of pediatric dentists reported that 87% of the parents are concerned about the esthetics of even posterior restorations. In addition,

studies suggest that even children are more concerned about esthetics as it influences their psychological well being and physical appearance[8,9].

The need to meet the demand for esthetic restorations led to the introduction of open faced stainless steel crowns, pre veneered crowns, polycarboxylate crowns and strip crowns. Each of these full coronal restorations has their own advantage and disadvantage. Initially preveneered stainless steel crowns showed short term success rate but long term follow-up studies have reported frequent fracture of these crowns as a whole or a part of it[4,10,11,12].

The technological advances in techniques and material science led to the evolution of preformed Zirconia crowns for primary teeth, so as to fulfill the esthetic demands, at the same time promise good durability. Zirconia crowns are known as "Ceramic Steel" as it provides strength close to available metal crowns as well as colour similar to that of natural teeth. Pediatric zirconia crowns were introduced by EZ-pedo and became commercially available in 2008. Later preformed zirconia crowns were popularized by companies like Nusmile, Kinderkrowns, Cheng crowns, Signature crowns and many more .These preformed crowns differed with respect to size, shape, shade and pattern of retention component[13]. Advantages of preformed zirconia crowns are its esthetics, full coverage of the treated tooth, no component of the crown that might debond and potentially less technique sensitive when compared to other esthetic alternatives. The potential disadvantages include

need for more tooth reduction[14], inability to crimp or contour the crown and they are also expensive.

Many of the studies with preformed zirconia crowns have been confined only to the anterior teeth[15,4]. Similarly it has been observed that impact of esthetics play an important role even in posterior primary teeth. Zirconia crowns are by far the strongest dental ceramic restoration available as preformed posterior esthetic crowns for primary dentition and very limited literature is available with regard to its efficiency and clinical performance. Thus this study was carried out to assess and compare the efficiency of zirconia crowns with stainless steel crowns used in posterior primary teeth and also to elicit parental satisfaction for the same.

Aims & Objectives

AIMS AND OBJECTIVES

1. To clinically evaluate the performance of pediatric preformed Posterior stainless steel crowns.
2. To clinically evaluate the performance of pediatric preformed posterior zirconia crowns.
3. To compare the clinical performance of posterior preformed zirconia with Stainless Steel Crowns.
4. To elicit parental acceptance and satisfaction with pediatric preformed Stainless Steel Crowns and zirconia crowns in posterior primary teeth.

Review of Literature

REVIEW OF LITERATURE

Messer et al (1988)[5] conducted a retrospective study to assess the durability of posterior stainless steel crowns placed on 331 primary molars in 131 patients were followed for up to 9 years, computerized, and their durability was assessed in terms of crown replacements and length of service. Of 331 crowns studied, 88% were successful either to tooth exfoliation or to the end of the study. The distribution of the 12%"true" failures showed a decreasing occurrence with increasing age of the child at first placement. The mean lifespan of failed crowns increased with placement age (15.3 months for children younger than 4 years; 24.1 months for 4-7 year olds; and 28.8 months for those older than 7 years), while the mean lifespan of successful crowns was 68.2 months for children younger than 4 years. The study also concluded that crowns placed in children younger than 4 years are predicted to show a success rate which is approximately twice that of Class II amalgams.

O'Sullivan, Tinanoff et al (1996)[1] in their study, assessed the development of caries in preschool children over two years according to baseline caries pattern. A total of 142 children were categorized at baseline as caries-free, having pit/fissure caries without maxillary anterior canes, or having maxillary anterior caries either alone or with posterior caries. The results showed that the mean posterior dmfs of children presenting with maxillary anterior caries at baseline was 5.0, and after **two** years these children had 10.1 affected posterior surfaces. The increment in posterior dmfs over the

two years was 2.1 times greater in the pit/fissure group than in the canes-free group and more than 3.7 times greater in the maxillary anterior group than in the caries-free group. The author suggested that efforts to develop caries interventions for children under age three might have considerable effect in-reducing the need for future dental treatment.

Fuks, Ram et al (1999)[10] did a clinical study comparing esthetic posterior crowns to conventional SSC in primary molars. 22 Crowns [11 conventional and 11 esthetic crowns] were placed in mandibular primary molars. The crowns were cemented and reviewed after 6 months for gingival health, marginal extension, crown adequacy, proper position, proximal contact, chipping of the facing. At 6 month evaluation all esthetic crowns were intact, without chipping of the facing. No difference was found for marginal extension, occlusion, proximal contact, crown adequacy and bone resorption. but a significant difference was found for periodontal health between esthetic crowns and conventional SSC .The study concluded that esthetic crowns assessed had several inconveniences, as they resulted in poor gingival health, are very expensive, and although not measured, are bulky and without a pleasing appearance.

Ram, Peretz et al (2000)[16] published a case report describing step-by-step method of placing composite crown-form crowns on severely decayed primary mandibular molars. A six year old girl who required an esthetic restoration of lower left primary molar was given composite resin restoration with a help of strip crowns. The author stated that these composite crown

forms possess disadvantage like problem with isolation. This case reported concluded that No longitudinal follow-up has yet been reported for the composite crown-form crowns, therefore parents and patients must be warned about the possible failure of the restoration, and the need for periodic follow-up appointments. Further research is needed to eliminate the possible disadvantages of the present crown-form composite restorations in order to meet with the increasing demand for esthetic restoration.

Robert, Lee et al (2001)[12] in their study evaluated the clinical success and parental acceptance of anterior primary dentition caries treatment with prefabricated resin-faced stainless steel crown. A retrospective analysis of maxillary anterior primary dentition caries treatment was performed.. Each crown was evaluated for retention, fracture, interface failure, color match, marginal integrity, and surface texture. Parental satisfaction regarding the esthetics of the crowns was evaluated by survey. The result of the study showed that thirty-eight crowns were evaluated in 12 children. Three teeth were lost to trauma with all other crowns remaining intact. Twelve crowns (32%) showed loss of at least some facial resin. Nine crowns (24%) had complete loss of the resin facing. Overall parental satisfaction with the treatment was excellent, however, satisfaction with crown esthetics received the lowest rating. The author concluded that even though parental satisfaction with treatment of anterior primary dentition caries with prefabricated resin-faced stainless steel crowns was excellent, the high failure rate of the resin facings was a drawback.

Ram, Fuks et al (2003)[11] conducted an invivo study on 10 children to evaluate the performance of esthetic primary molar crowns and conventional crowns using split mouth technique. The crowns were evaluated for gingival health, marginal extension, proper occlusion, clipping of the facing, cement removal. Radio graphic evaluation was done to check crown adequacy and bone resorption. The result suggested that one patient showed gingival bleeding present on probing of both crowns, the esthetic and the SSC. All the SSCs and 8 esthetic crowns occluded in a proper position the gingival health was good in both types of crowns.. All the 10 esthetic crowns presented chipping of the esthetic facing and, consequently, a very poor esthetic appearance.

Kupietzky, Waggoner et al (2004)[17] in their retrospective clinical study elicited the parental satisfaction of parents whose children received bonded resin composite strip crowns for primary incisors. 112 restorations were placed in 40 children and parental satisfaction was elicited after an 18 months follow up period. The questionnaire survey was based on the study conducted by Robert et al [5 point likert type scale]. Overall satisfaction was excellent with respect to size. The least score was for colour match. In spite of the low score, the overall satisfaction was positive. Parents, who were not satisfied with the durability [80%], reported less overall satisfaction with the crowns.

Mendes, De Benedetto et al (2004)[2] published a case report on Resin composite restoration in primary anterior teeth using short-post technique and strip crowns. This case report described a technique for the restoration of

endodontically treated primary maxillary incisors with resin composite short posts and celluloid strip crowns in a 3-year-old boy. The author concluded that technique offers the advantages of using one restorative material, improving esthetics, and reducing chair time and costs.

Shah, Lee et al (2004)[18] evaluated the efficiency of resin-veneered SSCs for primary upper anterior teeth as well as the parental satisfaction with it. This retrospective cross sectional study was done in 46 teeth in children of 3 - 6 years of age. The crowns were evaluated for retention of crowns facing, facing fracture, facing repair, facing colour match, marginal integrity and surface texture. Parental satisfaction was elicited with a questionnaire. Of the 46 teeth, 24% showed facing fracture. Complete resin retention was seen in 61% of teeth. Total parental average satisfaction score was 21 with the maximum being 25. Parental satisfaction with resin-veneered SSCs was very high, but clinical performance was not found to be very satisfactory.

Hickel, Kaaden et in 2005[19] reviewed the dental literature of 1971 up to July 2003 for longitudinal, controlled clinical studies and retrospective cross-sectional studies to check for longevity and reasons for failure of stainless steel crowns, amalgam, glass-ionomer, composite and compomer restorations in stress-bearing cavities of primary molars. Annual failure rates in stress-bearing cavities of primary molars were determined to be: 0-14% for stainless steel crowns, 0-35.3% for amalgam restorations, 0-25.8% for glass-ionomer restorations, 2-29.1% for atraumatic restorative treatments, 0-15% for

composite restorations, and 0-11 for compomer restorations. The review concluded that Stainless steel crowns are still the restorative procedure of choice for severely affected primary molars; however, especially in smaller cavities, the adhesive technique with compomers and composites can be used in a great number of cases when the child is cooperative. Important parameters such as patients' cooperation during treatment, caries activity, different material performances within one group of restorative materials and operator's experience affect clinical longevity of restorations in primary molars.

Fishman, Guelmann et al (2007)[9] conducted a study to evaluate the children's preference for posterior restorations. Hundred children in the age group of 5-12yrs responded to a survey after viewing photographs of amalgam, composite, colored compomer and stainless steel crowns. The study concluded that Composite resins were preferred the most and amalgam the least. Caucasians mostly selected composites while African Americans stainless steel crowns. Early interest in colored compomers was seen in young, males and Caucasians.

MacLean, Champagne et al (2007)[20] conducted a retrospective study to explore the clinical outcome of NuSmile Anterior pre-veneered stainless steel crowns. A total of 226 NuSmile crowns were evaluated in 46 of 49 eligible patients-21 females (46%) and 25 males (54%). Clinical outcomes were assessed by 3 calibrated examiners at recall, including presence, chipping, wear; crazing; and marginal location by clinical and radiographic examination.

Factors affecting placement such as operator experience and behavior were also assessed. 91% of NuSmile crowns retain a good to excellent overall appearance after 6 months. The study concluded that NuSmile anterior preveneered crowns are a clinically successful restoration for primary incisors with early childhood caries.

Usha, Deepak et al(2007)[3] published a case report documenting the restoration of severely mutilated lateral incisors in a 4- year- old female patient with early childhood caries. The restoration of severely decayed primary incisors is often a difficult procedure that presents a special challenge to pediatric dentists. Full mouth rehabilitation was done using stainless steel crowns, composite resin and glass ionomer cement. The author concluded that direct composite resin restoration using a custom made post with orthodontic wire used in this case report demonstrated good retention and esthetics.

Beattie, Taskonak et al[21] conducted an in vitro study in 2011 evaluating the fracture resistance of 3 types of primary esthetic SSC. 30 crowns from 3 different companies (EC crowns, Dental Innovators, Austin, TX; Kinder Krowns, St. Louis Park, MN; NuSmile Primary Crowns, Houston, TX) were obtained. The crowns negative replica was fabricated with polyvinylsiloxane impression material and allowed to set for 24 hours. This impression was then used to produce epoxy die. The esthetic SSC were cemented on to the epoxy dies. Each die–crown unit was placed into a custom made holder on a universal mechanical testing machine (MTS, Eden Prairie,

MN), and loading was increased until the crown fractured. The force required to fracture three brands of esthetic stainless steel crowns were 1730N ± 50N, 1826N±62N, 1671N±68N respectively with no significant difference between the groups and were well below the biting force of pediatric patients.

Karaca, Ozbay et al (2013)[22] published a case report where 2 children- a 4yrs old boy and a 4 yrs old girl were given preformed zirconia crowns in pulp treated anterior primary teeth. ZIRKIZ preformed zirconia crowns were luted with light cure resin cement. The clinical controls were performed at first week, first and third month as well as after 6 months and success was achieved. Esthetic results of the restoration significantly improved the child's mental state. The case report concluded that preformed zirconia crown with superior esthetics and natural appearance, created a new approach in restoring the natural appearance of a child's smile with a minimally invasive technique and short chair time.

Fuks et al in the year 2014[23], published a case report about restoration of severely decayed primary anteriors [Central and Laterals] in a 20 month old girl child was restored with Nusmile Zirconia crown under general anesthesia. A week after treatment the crown showed a perfect fit and gingiva was healthy. 45 days after treatment, the child presented with trauma to anterior teeth. Intra oral examination revealed that the maxillary right lateral incisors had suffered lateral luxation. On this occasion, it was noted that the crown was stable and did not show any damage. This case report suggest that zirconia

crowns are the most esthetic paediatric crowns to restore the natural appearance of a child's teeth compromised by caries or trauma.

In a case report by Ashima et al in 2014[24], reported a case of a four year old boy with dental caries treated with ZIRKIZ zirconia crowns for upper central incisors and composite restoration for canine following pulp by pulp therapy. Follow up was done every 3 months for a period of 30 months. The crown was checked for discolouration, fracture and opposing tooth wear. Over a 30 months period, the crowns demonstrated good retention and esthetics. The case report concluded that Zirconia seems to be a promising alternative for rehabilitation of decayed primary teeth.

Walia, Salami et al (2014)[4] in a randomised controlled trial evaluated three esthetic full-coronal restorations in primary maxillary teeth. 129 teeth in 39 children, 3-5 years of age were selected and assigned to 3 groups. (i) Composite strip crown. (ii) Pre-veneered stainless steel crowns (iii) Pre-fabricated primary zirconia crowns. Gingival health, restoration failure, tooth wear was elicited during 6 months follow up period. 78% of composite strip crowns were intact. 17% showed complete loss of strip crowns. 95% of PVSSCs were intact. 100% success rate was found with zirconia crowns. Opposing tooth wear was seen only in patients with zirconia crowns [10 %]. This study concluded that Composite strip crowns have lower success rate with respect to gingival health and retention. PVSSCs are retentive, but have

facial fracture. Pre-fabricated zirconia crowns are retentive and gingival friendly, but causes non-significant abrasion of opposing teeth.

Stober, Bermejo et al (2014)[25] did an invivo study to evaluate the enamel wear caused by monolithic zirconia crowns and to compare this with enamel wear caused by contra lateral natural antagonists. Twenty monolithic zirconia crowns were placed in 20 patients requiring full molar crowns. For measurement of wear, impressions of both jaws were made at baseline after crown cementation and at 6-month follow-up. Mean and maximum wear of the occlusal contact areas of the crowns of their natural antagonists and of the two contralateral natural antagonists were measured by the use of plaster replicas and 3D laser scanning methods. Wear differences were investigated by the use of two-sided paired Student's t-tests and by linear regression analysis. Mean vertical loss was 10 (43). µm for the zirconia crowns, 33 (112) µm for the opposing enamel, 10 (58) µm for the contralateral teeth and 10 (46) µm for the contralateral antagonists. Both mean and maximum enamel wear were significantly different between the antagonists of the zirconia crowns and the contralateral antagonists. Gender and activity of the masseter muscle at night were identified as possible confounders which significantly affected wear. Under clinical conditions, monolithic zirconia crowns seem to be associated with more wear of opposed enamel than are natural teeth.

Clark, Wells et al (2015)[14] did a study to assess amount of primary tooth reduction for anterior and posterior zirconia and SSC. One hundred

typodont teeth were selected and divided into 5 groups [for 4 commercially available zirconia crowns and 1 SSC]. 10 teeth were allotted for anterior teeth and 10 for posterior teeth in each group. Each typodont tooth was weighed 3 consecutive times and mean was taken. The size of the crowns used was selected with the Mesio-distal width of typodont tooth. After tooth preparation, each tooth was weighed and amount of tooth reduction was calculated by subtracting post preparation weight from pre preparation. The study results showed no significant difference among the four brands of zirconia, but the amount of tooth reduction for SSC was 48% less than that of 4 brands of zirconia crowns. For posterior teeth, there was a significant difference noted. Ez-Pedo, Kinder krown and NuSmile required less tooth reduction compared to Cheng crowns. The SSC required least preparation, which was 54% of that required for the composite of the four brands of zirconia restorations.

Tote, Godhane et al (2015)[13] in their review article explained about various posterior esthetic crowns in pediatric dentistry. This review deals about the different type of crowns, indication for each type of crown, method of preparation and cementation of each crown. The author concluded that impact of esthetics should always be considered in treatment plan as it has vital role in child's overall general health and psychological well being. Current wide ranges of available esthetic crows help us to meet the parental satisfaction and acceptance in terms of esthetics.

So-Youn An, Youn-soo shim et al (2015)[26] reported a case of 3 year old female child treated with ZIRKIZ zirconia crowns for rehabilitation of maxillary anterior tooth followed for a period of 18 months at Wonkwang University.. The zirconia crown was pre-surface treated with 10-MDP and luted with self-etching adhesive resin cement. During the follow up period, the crown was compared with adjacent open face crowns. At the 6, 12 and 18 months follow up, the tooth was asymptomatic with successful retention, both patients and care giver were satisfied with Zirconia crowns. The author concluded that Zirconia crowns are a good treatment option for restoring primary anterior teeth.

A randomized controlled trial was conducted by A A Salami, Walia et al (2015)[27] to assess parental satisfaction with 3 tooth coloured full-coronal restorations in 129 primary maxillary incisors of 39 children. Parental satisfaction was elicited at base line and after one year among three groups (Group A evaluated Composite strip crowns, Group B - PVSSC and Group C - Zirconia crowns). Parental satisfaction was recorded regarding the crown's shape, size, colour, durability and their overall satisfaction using Likert type scale and pain experienced by the child at base line using visual analogue scale. The result showed the parents were satisfied with colour, size and shape of composite strip crowns while parents whose children received PVSSCs were not satisfied with colour [33 %]. All the parents were satisfied with

zirconia crown. Overall satisfaction with Zirconia was 100%, Composite strip crown 84% and PVSSCs was 75%.

A study conducted by Jae-Won Choi, Hwan Noh et al (2016)[28] evaluated the effects of full coverage all-ceramic zirconia, lithium disilicate glass-ceramic, leucite glass-ceramic and stainless steel crowns on antagonistic primary tooth wear. In this study, primary canine teeth [40] with no cusp wear were mounted on acrylic resin to act as antagonistic teeth. The 40 teeth were assigned equally to stainless steel group, leucite ceramic group, lithium group and zirconia group. Using milling machine, 11 mm diameter and 13 mm high specimens were prepared and placed in Ann acrylic resin. Wear test was conducted and amount of volume of tooth loss was scanned using a 3D scanner. The study concluded that Leucite group showed greatest tooth volume loss followed by Lithium, then steel group. No difference was found between zirconia group and steel group. The SEM images of steel group showed smooth surfaces, fragmentation and striated plot marks. Leucite and Lithium groups showed notable surface changes. Zirconia group showed no chips or fracture. This study concluded that Leucite and Lithium are abrasive compared to stainless steel and zirconia.

Abdrabuh, Howaidi et al (2016)[29] published a case report where an 8 year old male patient with Amelogenesis Imperfecta was treated with direct composite veneers on the permanent upper and lower incisors, zirconia crowns (NuSmile) on the primary molar and canines and stainless steel crowns on the

first permanent molar. Follow-up was done for a period of 18 month period. The adaptation and quality of the margins of the performed SSCs and the zirconia crowns were evaluated using panoramic and bitewings radiographs and found to be successful. The author stated that these crowns improved the vertical dimension of the patients teeth, improved chewing ability and reduced tooth sensitivity and provided an esthetic appearance. The author concluded that AI can be managed through restorative dental and orthodontic treatment. Stainless steel crowns, Zirconia crowns and composite veneers are an effective intervention and can be applied to primary and early permanent dentition.

Ahmed, Aly et al (2016)[30] did an in vitro study to assess the wear of primary enamel against 3 full coronal coverage - SSC, PVSSC, Zirconia. A total of 30 primary natural molars were mounted onto acrylic resin moulds. 30 primary molar crowns were selected to be opponent to the selected extracted teeth. Wear test was performed and procedure was carried out to 2,00,000 cycles, which is equivalent to approximately 1 year of wear. The natural teeth were weighed before and after the test. SEM examination was done. The study concluded that the enamel wear was high with zirconia crowns followed by SSC and PVSSC. In SEM examination, zirconia antagonist showed multiple cracking with complete absence of normal enamel nods. PVSSC showed a typical orientation of enamel rods. SSC showed multiple cracks with hypo- mineralized erosive patterns.

Pani, Saffan et al[8] in 2016 did a study to compare the opinions of children aged 5–8 years to have an opinion regarding the changes in appearance of their teeth due to dental caries and the materials used to restore those teeth. A total of 107 children and both of their parents (321), who were seeking dental treatment, were included in this study. A tool comprising a questionnaire and pictures of carious lesions and their treatment arranged in the form of a presentation was validated and tested on 20 children and their parents. The validated tool was then tested on all participants. The results showed that children had acceptable validity statistics for the tool suggesting that they were able to make informed decisions regarding esthetic restorations. There was no difference between the responses of the children and their parents on most points. Zirconia crowns appeared to be the most acceptable full coverage restoration for primary anterior teeth among both children and their parents. The author concluded that children in their sixth year of life are capable of appreciating the esthetics of the restorations for their anterior teeth.

Holsinger, Wells et al (2016)[15] in a retrospective study evaluated the clinical performance and parental satisfaction with paediatric zirconia anterior crowns. 57 crowns were evaluated in 18 children for retention, gingival health, colour match, contour, marginal integrity and opposing tooth wear. Parental satisfaction with respect to colour, shape and size of crown and parental perception of the impact of treatment on the children was evaluated by a questionnaire. 96% of crowns were retained, no opposing tooth near was

observed. 36% showed gingival inflammation. 89% of the parents reported that they would highly recommend zirconia crowns. The study concluded that zirconia crowns are an acceptable restoration option in primary maxillary anterior.

Vinson, McCrea et al (2016)[31] conducted a study to determine the maximum occlusal load to cause failure of an ESSC (NuSmile) and 2 types of primary full ceramic crowns (Kinder Krown and EZ Pedo). Negative replicas of each company's crown were fabricated with polyvinyl siloxane impression material, allowed to set for 24 hours and used to fabricate epoxy dies for each crown. The crowns were cemented to the epoxy dies with glass ionomer cement. The die-crown units were fractured using a universal testing machine with a stainless steel ball fixture, set in a uniaxial lever. Kinder Krown crowns had a significantly lower force required to fracture than the EZ Pedo and NuSmile crowns. The force to fracture the EZ Pedo and NuSmile crowns was not significantly different between these two. The three types of crowns tested withstood the application of uniaxial forces greater than the reference values for posterior occlusal loads.

Abdulhadi, Abdullah et al in 2017[7] in their study compared the clinical performance of zirconia crowns with that of SSC in primary molar teeth. A sample of 120 contra lateral primary molars in 26 patients within the age group of 4-8 years was selected. A split mouth design was followed (i.e) 60 tooth were given SSC and 60 tooth were given zirconia crowns. The

evaluation of each crown restoration was assessed at the base line, 3, 6 and 12 months. Clinical failure parameters were evaluated with visual assessment of the restoration, according to the United States Public Health Service alpha criteria rating system. The gingival health and plaque index were evaluated. At 3 months follow up, 80% of teeth were zirconia showed no gingival bleeding, compared to 13% in SSC group. At 12th month, all teeth in both groups showed no inflammation. Plaque index (Silness and Loe criteria) at the base line showed 100% absence of plaque in both groups. During 3 month follow up period, 73.3% of teeth covered by zirconia showed a plaque film compared to only 53% in SSC group. During 6 month, it was 16.7% in zirconia and 66.7% in SSC group. Finally at the 12 months follow up, 100% no plaque accumulation was seen with zirconia, where it was 75% in SSC group. All teeth on both groups were presented at the 12 months follow up without carries and with normal appearance of crowns. The study concluded that zirconia crowns perform better in the aspect of esthetics, gingival response and plaque retention despite its high cost.

Akhlaghi, Hajiahmadi et al (2017)[32] conducted a study to investigate the attitude of parents and children toward the application of stainless steel crown (SSC) on primary molars. This cross-sectional descriptive study included eighty 4–6-year-old children having treated with SSC over the past 3–6 months. A validated child- and parent-centered self-report questionnaire was used to assess parent's attitude. The score of children's attitude was

positive; attitudes of 82.43% of children were good. Parents had neutral attitude. Only 53% of the parents scored good attitudes. The study concluded that attitude score of children toward SSC was good and independent of age, gender, career, and education of the parents. Although the parents were not satisfied with how it appeared, the majority of them reported that their child had well accepted the crown.

Cazaux, Hyon et al (2017)[33] published a case report describing the restoration of a primary mandibular molar with a zirconia crown(EZ-Pedo, Loomis, California, USA) in an 8-year old boy. Crown preparation was done and zirconia crown was luted with glass ionomer cement (Fuji One PLUS, GC).The patient was followed for 29 months until the natural exfoliation of his tooth. Long-term follow–up indicated the good health of the periodontal tissues. No accelerated attrition of the opposing tooth was noted. The case report suggested that a pediatric zirconia crown allows sustainable functional restoration while restoring a natural appearance of the tooth.

Amit Khatri in 2017[34] published a case report, where a four year old boy was given zirconia crown (EZ-Pedo) in relation to 51. Crown preparation was done to achieve passive fit. The final passive fit of the crown was confirmed and cemented with type 1 GIC (Ketac 3M ESPE, St. Paul, MN, USA). The author suggested that the presence of adequate clearance, proper angulations and visible knife edge finish lines helps to preserve gingival health and less plaque accumulation. The author concluded that zirconia crowns

offer high-end esthetics, superior durability and easy placement compare to composite restorations and strip crowns.

Kim, Park et al (2018)[35] conducted a study to compare the bond strength of pediatric zirconia crown after cleaning the crowns contaminated with blood or saliva and to determine the effect of thermocycling. A total of nine experimental groups were used in this study Group 1 (Positive Control, PC) No contamination, Group 2 (Saliva contamination - Ivoclean cleaning, Group 3 (Saliva contamination - 2.5% NaOCl cleaning, Group 4 (Saliva contamination - 37% phosphoric acid gel cleaning, Group 5 (Saliva contamination- Negative control, Group 6 (Blood contamination - Ivoclean cleaning, Group 7 (Blood contamination - 2.5% NaOCl cleaning, Group 8 (Blood contamination - 37% phosphoric acid gel cleaning and Group 9 (Blood contamination – Negative control) . Each experimental group was divided into two subgroups (subgroup A, subgroup B). Subgroup A was stored in wetting thermostat at 37℃ for 24 hours without thermocycling before measuring shear bond strength. Subgroup B was stored in wetting thermostat at 37℃ for 24 hours followed by thermocycling (5℃ and 55℃ for 30 seconds, 30,000 times). Shear bond strength of specimen was measured using Universal Testing Machine. Shear bond strength of specimen in the non - contaminated group was not significantly different from that of Ivoclean or 2.5% NaOCl cleaned group. Shear bond strength of specimen in phosphate cleaned group was significantly lower compared to that in Ivoclean or 2.5% NaOCl cleaned

group. All experimental groups showed significant reductions in shear bond strength after thermocycling treatment. Saliva or blood contaminated specimens cleansed with 37% phosphate gel showed statistically significant reduction in shear bond strength. The author concluded that when zirconia crowns were contaminated with blood and saliva cleaning with commercial cleanser or 2.5% NaOCl will not influence the shear bond strength of the crowns.

Materials & Methods

MATERIALS AND METHODS

The study is a prospective clinical trial done to evaluate and compare the efficacy of preformed posterior zirconia crowns and stainless steel crowns. The study was approved by the Institutional review board of RAGAS DENTAL COLLEGE AND HOSPITAL (affiliated to Tamilnadu Dr.M.G.R. Medical University, Chennai).

SAMPLE SIZE DETERMINATION

Based on the findings of pilot study conducted with 10 teeth (5 in each group) taking alpha error of 0.05 and 90% power, a sample size of 28 in each group was determined. Accounting for 20% loss to follow up the total number of crowns to be evaluated per group was decided to be 35(28 +20% of 28). Overall 70 crowns (35 stainless steel and 35 zirconia crowns were decided to be placed).

SAMPLE POPULATION

The study was started with seventy pulp treated (pulpectomy, pulpotomy) primary molars of twenty nine children aged between 3-9 years and restored with preformed pediatric crowns of which thirty five were zirconia crowns and thirty five were stainless steel crowns. The clinical performance of these crowns was assessed for a period of one year at 3 months interval. Three children

(3 zirconia and 4 Stainless Steel Crowns) were dropped out of the study at 3rd month review and one tooth with zirconia crown was extracted and excluded from the study, one crown was replaced with customized zirconia crown at 6th month review and recorded as restoration failure. A total of thirty one stainless steel crowns and thirty zirconia crowns were available for 1 year follow up for assessing all other parameters. Parental satisfaction was assessed using a 5 point likert type questionnaire[12,27].

ARMAMENTARIUM:

1. FOR INVESTIGATION

A sterile kit with

- Mouth mirror
- Straight probe
- Explorer
- Tweezer,
- Kidney tray.
- Mouth mask and disposable gloves.
- Cotton Holder

2. PULP THERAPY

- Lignocaine-Local anesthetic solution and topical anesthesia gel
- 2.5 ml disposable syringe.

- High-speed air rotor hand piece.
- Burs-round burs, non-end cutting burs.
- Spoon excavators
- Broaches, K-file(10-35), H-file(10-35)
- Irrigating solution-2% Chlorhexidine, normal saline
- 5ml disposable syringe
- Absorbent paper points
- Obturating material-Calcium hydroxide and iodoform (METAPEX)
- Type IX GIC(GC)

3. CROWN PREPARATION BURS-

a. FOR ZIRCONIA

- WR-13,EX20
- TC21,CD-59F

b. FOR STAINLESS STEEL

- No-330
- No169 L

4. STAINLESS STEEL CROWN PLIERS

- Crown contouring plier
- Crown crimping plier
- Straight hoe
- Crown remover

5. PREFORMED ZIRCONIA crowns-Kinder krowns

6. PREFORMED STAINLESS STEEL CROWNS-kids crowns

7. LUTING CEMENTS-

- Dual cure resin cement for zirconia-relyx-300
- Type 1 GIC luting cement-GC Company.

8. MISCELLANEOUS:

- Light cure unit.
- Cotton rolls and suction tips for isolation.
- X-RAY unit
- IOPA films
- Agate spatula, mixing pad

9. 5 point likert type questionnaire.

INCLUSION CRITERIA:

1. Children who required pulp therapy in primary molars indicated for full coverage restoration following pulpectomy or pulpotomy.
2. Healthy children, free of any systemic disease or any developmental disturbances of the teeth.
3. Children for whom consent was obtained from parents/guardians.

EXCLUSION CRITERIA:

1. Teeth with pathological root resorption or inadequate root support.
2. Tooth with infection involving the furcation.
3. Children with para functional habits.
4. Teeth with inadequate crown structure.

CLINICAL PROCEDURE-

Based on the inclusion criteria, teeth were selected and randomly assigned (by convenience sampling) to one of the following groups.

a. Group 1-Preformed zirconia crowns
b. Group 2-Preformed stainless steel crowns

Upper / Lower primary molars in 29 children aged between 3-9yrs were allotted randomly to either preformed zirconia crown group or stainless steel crown group, following pulp therapy (2 pulpotomy, 68 pulpectomy).

TOOTH PREPARATION FOR STAINLESS STEEL CROWNS

Tooth preparation was done with No.330 or tapered diamond bur to reduce occlusal surface by 1- 1.5mm. Care was taken to produce uniform occlusal reduction. Inter proximal reduction was done mesially and distally with No.169 L tapered diamond bur in such a way that straight probe passes freely through the contact area. Roundening of line angles done and a knife-edge finish margin of the proximal surface was obtained. Care was taken to avoid any ledge formation.

An appropriate size crown was chosen according to mesiodistal width of the prepared tooth and trial fit was carried out before cementation. The crown was crimped using No.800-417 crown-crimping plier. Finally the crown was luted with type 1 GIC, the flash was removed with an explorer and final occlusion was checked[36].

TOOTH PREPARATION FOR PREFORMED ZIRCONIA CROWNS

The tooth preparation was done following the manufacturer's guidelines[37]. The occlusal surface was reduced to a thickness of 1.5-2mm with WR-13l diamond bur. Interproximal contacts was broken using CD-59F tapered fissure bur. The tooth was trimmed down circumferentially by around 20%–30%, or 0.5–1.25 mm with the help of TC-21 tapered diamond or carbide burs.

1–2 mm subgingival preparation was done to achieve feather-edge finish line. Care was taken to not to create any undercuts. A slim, narrowed diamond bur was utilized to prevent the breaking up of tissue during the execution of such subgingival tooth modifications.

Selected preformed crown was placed on the prepared tooth. Prepared tooth was made free from any blood or saliva. Passive fit of the crown and occlusion was checked and the crown was luted with dual cure resin cement

(relyx-300). Consistent firm finger pressure was applied during cementation. Care was taken to stabilize the crown in position till the cement has completely hardened. The access cavity of the pulp treated tooth was finally sealed using Glass ionomer cement, so as to obtain better bond between the luting cement and access cavity cement.

Evaluation criteria

The evaluation of each crown restoration was assessed at the baseline which is on the same day of the procedure and the follow-up was done with an interval of 3 months till 12th month. Clinical evaluation criteria included crown retention, opposing tooth wear, marginal integrity, plaque score, gingival health, proximal contact. Parental satisfaction regarding the size, shape, colour, durability and overall satisfaction, impact on oral health and appearance was assessed after placement of the crown with 5-point likert type questionnaire with '1-Verydissatisfied, 2-Dissatisfied, 3-Neutral, 4-Satisfied and 5-Very satisfied'. The problems encountered by the children such as bleeding around crown, sensitivity and food lodgement and future treatment options were evaluated with an 'Yes/No' dichotomous questions. Results were tabulated and statistically analysed[7,15,27].

STASTICAL ANALYSIS

The data was entered in the Microsoft Excel spread sheet and analyzed with WILCOXON SIGNED RANK TEST for within group comparison and MANN-WHITNEY U TEST for inter group comparison. The level of significance was set at 0.05.

EVALUATION CRITERIA:

Clinical Evaluation

1. Crown retention
    a. Intact
    b. Chipped
    c. Complete loss
2. Marginal integrity
    a. Closed
    b. Open
3. Opposing tooth wear
    a. Wear
    b. No wear
4. Gingival inflammation
    a. Mild
    b. Moderate
    c. Severe
5. Proximal contact
    a. Intact
    b. Lost
6. Plaque accumulation
    a. No plaque
    b. Mild plaque not visible to naked eye.
    c. Plaque visible to naked eye

1. PARENTAL SATISFACTION:

Category
1. Size
2. Shape
3. Colour
4.Durability
5. Impact on oral health and appearance
6.Over all satisfaction

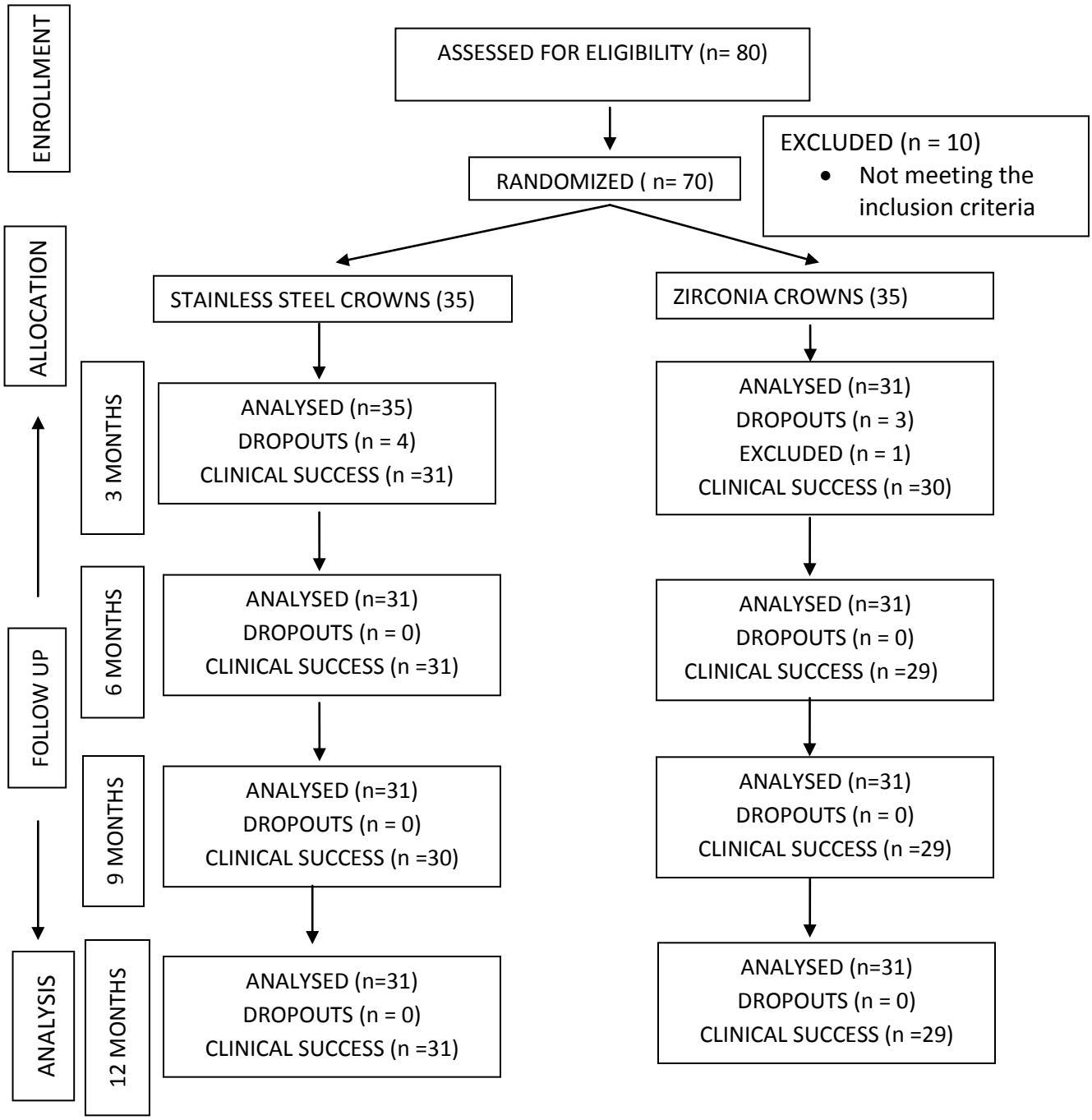
Scoring criteria
Score 1 – Very Dissatisfied
Score 2 – Dissatisfied
Score 3 – Neutral
Score 4 – Satisfied
Score 5 – Very Satisfied

2. PROBLEMS EXPERIENCED BY THE CHILD:

Category
1. Bleeding around crown – YES / NO
2. Sensitivity – YES / NO
3. Food lodgment – YES / NO

3. FUTURE TREATMENT CHOICE:

Category	Stainless steel crown – YES / NO	Zirconia crown – YES / NO


ENROLLMENT
ASSESSED FOR ELIGIBILITY (n= 80)
EXCLUDED (n = 10)
Not meeting the inclusion criteria
RANDOMIZED (n= 70)
ALLOCATION
STAINLESS STEEL CROWNS (35)
ZIRCONIA CROWNS (35)
3 MONTHS
ANALYSED (n=35)
DROPOUTS (n = 4)
CLINICAL SUCCESS (n =31)
ANALYSED (n=31)
DROPOUTS (n = 3)
EXCLUDED (n = 1)
CLINICAL SUCCESS (n =30)
FOLLOW UP
6 MONTHS
ANALYSED (n=31)
DROPOUTS (n = 0)
CLINICAL SUCCESS (n =31)
ANALYSED (n=31)
DROPOUTS (n = 0)
CLINICAL SUCCESS (n =29)
9 MONTHS
ANALYSED (n=31)
DROPOUTS (n = 0)
CLINICAL SUCCESS (n =30)
ANALYSED (n=31)
DROPOUTS (n = 0)
CLINICAL SUCCESS (n =29)
ANALYSIS
12 MONTHS
ANALYSED (n=31)
DROPOUTS (n = 0)
CLINICAL SUCCESS (n =31)
ANALYSED (n=31)
DROPOUTS (n = 0)
CLINICAL SUCCESS (n =29)

ARMAMENTARIUM

INSTRUMENTS USED FOR PULP THERAPY AND TOOTH PREPARATION FOR STAINLESS STEEL CROWN AND ZIRCONIA CROWN

INTRA ORAL IMAGES OF ZIRCONIA CROWNS AND STAINLESS STEEL

PRE OPERATIVE MAXILLARY PHOTOGRAPH

PRE OPERATIVE MANDIBULAR PHOTOGRAPH

PRE OPERATIVE OCCLUSION PHOTOGRAPH

POST OPERATIVE MAXILLARY PHOTOGRAPH

POST OPERATIVE MANDIBULAR PHOTOGRAPH

POST OPERATIVE OCCLUSION PHOTOGRAPH

Results

RESULTS

29 children (13 male, 16 females) were treated with 70 preformed posterior primary (35 zirconia and 35 stainless steel crowns). Three children (3 zirconia and 4 SSC) dropped out of the study at 3rd month review and one tooth with zirconia crown was extracted due to periapical infection was excluded from the study. One zirconia crown was dislodged due to occlusal disharmony and replaced with customized zirconia crown at 6th month review, which was recorded as restoration failure and not assessed for rest of the parameters. One stainless steel crown dislodged at 9th month review was re-cemented and followed up but was recorded as restoration failure, thus other parameters were not assessed for that crown. A total of 31 preformed zirconia crowns and 31 SSC were followed up for a period of one year with 3 months interval.

At the end of 3 months, one out of thirty one (3.1%) preformed zirconia crowns showed chipping of the crown and was repaired with composite resin restoration. Whereas all the thirty one stainless steel crowns (100%) were intact.

At the end of 6 months, one out of thirty one (3.2%) crowns showed complete dislodgement with respect to zirconia crown, which was replaced by customized zirconia crown and recorded as restoration failure. All the stainless steel crowns remained intact (100%).

At the end of 9th month, twenty nine (96.6%) of zirconia crowns were intact and showed good retention, whereas one (3.2%) of the thirty one stainless steel crowns showed complete loss of crown. The crown was recemented and followed till the end of study period as the tooth was found to be asymptomatic otherwise but was recorded as restoration failure.

At the end of 12th month review twenty nine (96.6%) of zirconia crowns and thirty one (100%) of SSC was intact. There is no significant difference in the retention ability of zirconia and stainless steel crown (p=1.000).

Marginal integrity of the assessed crowns showed that all remaining thirty zirconia crowns (excluding the chipped crown) showed closed margins (96.8%) during the 3rd month follow-up period. Thirty one (100%) stainless steel crowns showed closed margins.

At the end of 6 months, thirty one (100%) of SSC showed closed margins and thirty (100%) of zirconia crowns showed closed margins and one of the zirconia crown which was replaced was not assessed.

There was no alteration observed with respect to marginal integrity in preformed zirconia crowns at the end of 9th and 12th month follow-up. With respect to stainless steel crown, excluding the crown that lost retention, all other thirty (100%) crowns showed closed margins during the 9th month follow-up. 100% success was seen in both the groups by the end of 12 months.

There is no significant difference between the groups with respect to marginal integrity (p=1.000).

Plaque score of the study group showed that one teeth (3.2%) of the zirconia group showed visible plaque accumulation during the 3rd month follow-up, whereas thirty one (100%) SSCs showed no plaque accumulation.

At 6th month review, two (6.6%) of the zirconia crowns showed visible plaque accumulation and thirty one (100%) of Stainless steel crowns showed no plaque accumulation.

At the end of 9th month, both the groups showed no plaque accumulation, in thirty (100%) of the zirconia crowns and thirty (100%) of SSCs excluding the one that lost the retention.

100% success was observed in both the groups with respect to plaque score at the end of 12th month follow-up. The difference in plaque scores between the groups were found to be insignificant (p=0.314).

The gingival health of the children showed that one tooth (3.2%) of the zirconia group revealed mild inflammation during the 3rd month follow-up, whereas thirty one (100%) SSCs showed no signs of inflammation.

At 6th month review, two (6.6%) of the zirconia crowns showed mild inflammation with bleeding on probing and thirty one (100%) of Stainless steel crowns showed no inflammation.

At the end of 9th month, both the groups showed good gingival health in thirty (100%) of the zirconia crowns and thirty (100%) of SSCs excluding the one that lost the retention.

100% success was observed in both the groups with respect to gingival health at the end of 12th month follow-up. There is no significant difference between zirconia crowns and stainless steel crowns with respect to gingival status (p=0.317).

Good proximal contact was observed throughout the follow-up period in both preformed zirconia and SSC group [Thirty one (100%) – Stainless steel and Thirty (100%) zirconia crowns] and no opposing tooth wear was evident in both the groups throughout the follow-up period. Both the groups clinically showed no significant difference with respect to proximal contact and opposing tooth wear.

PARENTAL SATISFACTION

Parental satisfaction was obtained from 25 parents with the help of 5 point likert type scale regarding size, shape, colour, durability, impact on oral health and appearance along with it problems associated with crown placement such as sensitivity, bleeding around gums and food lodgment as well as future treatment considerations were elicited with a dichotomous 'Yes/No' questionnaire.

The majority of the parents were satisfied with size and shape of crowns with a mean score of 4.3 on l5-point likert scale for stainless steel crowns (80%) and 4.8 with zirconia crowns (96%).

All the parents were satisfied with the colour of zirconia crowns (100%) with the mean score of 5, whereas only 36% were not satisfied with colour of stainless steel crowns, 32% were neutral and 32% reported no objection with colour of stainless steel crowns.

96% of the parents were satisfied with durability of crowns in both the groups, where 4% of them reported complete loss of crowns atleast once.

Majority of the parents reported improvement of child's oral health after placement of crowns in both the groups, with a mean of 4.8 (96%).

Overall satisfaction with stainless steel crowns were good with the mean score of 4.2 (78%) and was higher with zirconia crown with a mean of 4.8 (96%). [p=0.03]

Problems experienced by the children were evaluated with a 'Yes/No' question. Parents reported that there was no difficulties such as sensitivity, bleeding around crown and food lodgment with stainless steel crowns where as 8% of them reported bleeding around the crown with zirconia crowns. No problem was reported with respect to sensitivity and food lodgment in zirconia group.

15 (60%) of the stainless steel group and 25 (100%) of zirconia group parents were ready to opt these crowns for the future requirement of their children and recommend for other children as well. [p=0.021]

12^{th} month review showed twenty nine (93.5%) of zirconia crowns were intact and thirty one (100%) of stainless steel crowns were found to be intact. All the evaluated crowns from both the groups showed 100% good marginal adaptation. Both the crowns maintained 100% (31/31 – stainless steel, 30/30 – zirconia) good proximal contact and reported no opposing tooth wear. Good gingival health and plaque score was maintained with both the groups. Zirconia crowns showed 93.5% overall success rate whereas stainless steel crowns showed 96.7% success rate, with no significant difference between the groups.

Majority of the parents in both the groups (78% SSCs and 96% zirconia crowns) were satisfied with the crowns. Mild bleeding (8%) was reported in zirconia group. Parents were ready to recommend both the crowns with preference for zirconia crowns because of its colour being similar to that of natural teeth.

3rd MONTH FOLLOW-UP PHOTOGRAPHS

MAXILLARY OCCLUSAL IMAGE

MANDIBULAR OCCLUSAL IMAGE

TEETH IN OCCLUSION

6th MONTH FOLLOW-UP PHOTOGRAPHS

MAXILLARY OCCLUSAL IMAGE

MANDIBULAR OCCLUSAL IMAGE

TEETH IN OCCLUSION

9th MONTH FOLLOW-UP PHOTOGRAPHS

MAXILLARY OCCLUSAL IMAGE

MANDIBULAR OCCLUSAL IMAGE

TEETH IN OCCLUSION

12th MONTH FOLLOW-UP PHOTOGRAPHS

MAXILLARY OCCLUSAL IMAGE

MANDIBULAR OCCLUSAL IMAGE

TEETH IN OCCLUSION

CHIPPING AND FRACTURE OF CROWN

PREFORMED ZIRCONIA CHANGED TO CUSTOM MADE ZIRCONIA CROWN

Tables and Graphs

TABLE 1: RETENTION OF STAINLESS STEEL AND ZIRCONIA CROWN AT 3,6,9 AND 12th MONTH FOLLOW-UP VISIT

CATEGORY	**STAINLESS STEEL CROWN**				**ZIRCONIA CROWNS**			
	3 M (31)	6M (31)	9M (31)	12M (31)	3M (32)	6M (31)	9M (31)	12M (31)
1. CROWN RETENTION								
a) Intact	31/31 100%	31/31 100%	30/31 96.77%	31/31 100%	30/31 96.77%	29/31 93.5%	29/30 96.6%	29/30 96.6%
b) Chipped	-	-	-	-	1/31(3.2%)	1/31(3.2%)	1/30(3.3%)	1/30(3.3%)
c) complete loss	-	-	1/31 3.2%	-	-	1/31(3.2%)	-	-
NOT ASSESSED	-	-	-	-	-	-	1/31(3.2%)	1/31(3.2%)

TABLE 2: MARGINAL INTEGRITY OF STAINLESS STEEL AND ZIRCONIA CROWN AT 3,6,9 AND 12th MONTH FOLLOW-UP VISIT

CATEGORY	STAINLESS STEEL CROWNS				ZIRCONIA CROWNS			
	3 M (31)	6M (31)	9M (31)	12M (31)	3M (32)	6M (31)	9M (31)	12M (31)
2. MARGINAL INTEGRITY								
a) Closed	31/31 100%	31/31 100%	30/30 100%	31/31 100%	30/31(96.7%)	30/30 (100%)	30/30 (100%)	30/30 (100%)
b) Open	-	-	-	-	1/31(3.2%)	-	-	-
NOT ASSESSED	-	-	1/31 3.2%	-	-	1/31(3.2%)	1/31(3.2%)	1/31(3.2%)

TABLE 3: OPPOSING TOOTH WEAR CAUSED BY STAINLESS STEEL AND ZIRCONIA CROWNS AT 3,6,9,12TH MONTH FOLLOW-UP VISIT

CATERGORY	**STAINLESS STEEL CROWNS**				**ZIROCONIA CROWNS**			
	3 M (31)	6M (31)	9M (31)	12M (31)	3M (32)	6M (31)	9M (31)	12M (31)
3. Opposing tooth wear								
a) Wear	-	-	-	-	-	-	-	-
b) No wear	31/31(100%)	31/31100%	31/31100%	31/31100%	31/31(100%)	31/31(100%)	31/31(100%)	31/31(100%)
NOT ASSESSED	-	-	-	-	-	-	-	-

TABLE 4: PROXIMAL CONTACT WITH STAINLESS STEEL AND ZIRCONIA CROWNS AT 3,6,9 AND 12th MONTH FOLLOW-UP VISIT

CATEGORY	**STAINLESS STEEL CROWNS**				**ZIRCONIA CROWNS**			
	3 M (31)	6M (31)	9M (31)	12M (31)	3M (32)	6M (31)	9M (31)	12M (31)
4.. PROXIMAL CONTACT								
a) Intact	31/31 (100%)	31/31 (100%)	30/31 (96.7%)	31/31 (100%)	31/31 (100%)	30/30 (100%)	30/30 (100%)	30/30 (100%)
b) Lost	-	-	1/31 (3.2%)	-	-	-	-	-
NOT ASSESSED	-	-		-	-	-	-	-

TABLE 5: PLAQUE ACCUMULATION WITH STAINLESS STEEL AND ZIRCONIA CROWN AT 3,6,9 AND 12th MONTH FOLLOW-UP VISIT

CATEGORY	STAINLESS STEEL CROWNS				ZIRCONIA CROWNS			
	3 M (31)	6M (31)	9M (31)	12M (31)	3M (32)	6M (31)	9M (31)	12M (31)
5. PLAQUE INDEX								
a) No plaque	31/31 (100%)	31/31 (100%)	31/31 (100%)	31/31 (100%)	30/31 (96.7%)	28/30 (93.3%)	30/30 (100%)	30/30 (100%)
b) Plaque not seen by naked eye	-	-	-	-	-	-	-	-
c)Plaque seen by naked eye	-	-	-	-	1/31(3.2%)	2/30(6.6%)	-	-
NOT ASSESSED	-	-	-	-	-	1/31(3.2%)	1/31(3.2%)	1/31(3.2%)

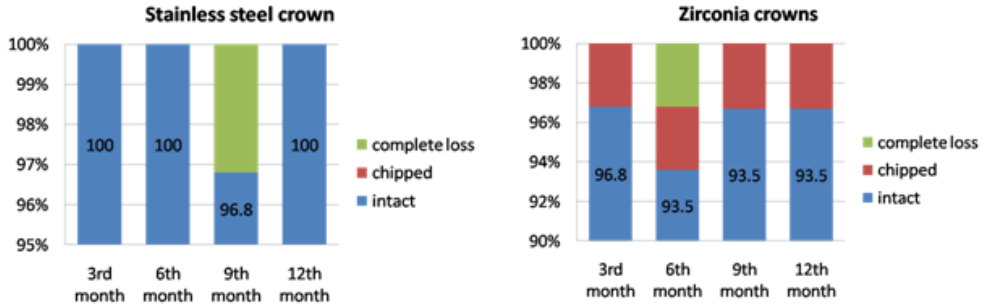
TABLE 6: GINGIVAL INFLAMMATION WITH STAINLESS STEEL AND ZIRCONIA CROWNS AT 3,6,9 AND 12th MONTH FOLLOW-UP VISIT

CATEGORY	STAINLESS STEEL CROWN				ZIRCONIA CROWNS			
	3 M (31)	6M (31)	9M (31)	12M (31)	3M (32)	6M (31)	9M (31)	12M (31)
6..GINGIVAL INFLAMMATION								
a)N o inflammation	31/31 (100%)	31/31 (100%)	31/31 (100%)	31/31 (100%)	30/31 (96.7%)	28/30 (93.3%)	30/30 (100%)	30/30 (100%)
b) Mild	-	-	-	-	1/31(3.2%)	2/30(6.6%)	-	-
c) Moderate	-	-	-	-	-	-	-	-
d) Severe	-	-	-	-	-	-	-	-
NOT ASSESSED	-	-	-	-	-	1/31(3.2%)	1/31(3.2%)	1/31(3.2%)

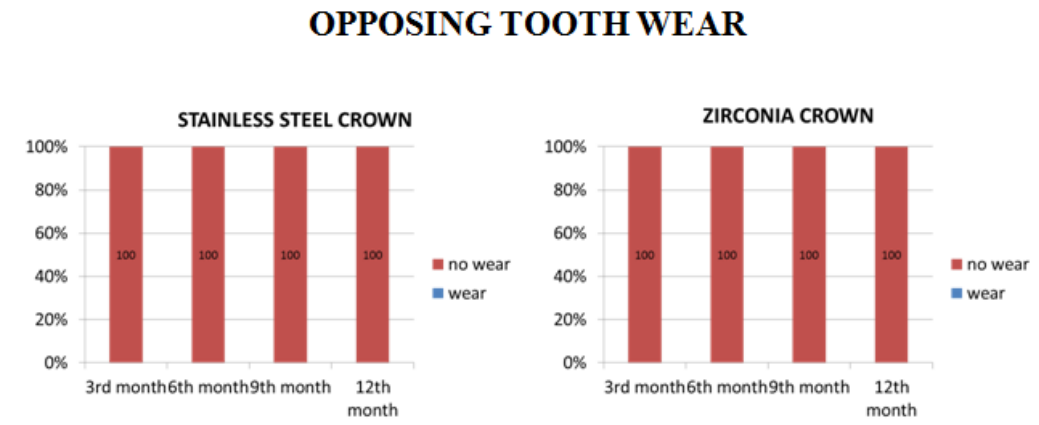
MARGINAL INTEGRITY

GRAPH1: COMPARISON OF MARGINAL INTEGRITY OF STAINLESS STEEL AND ZIRCONIA CROWN

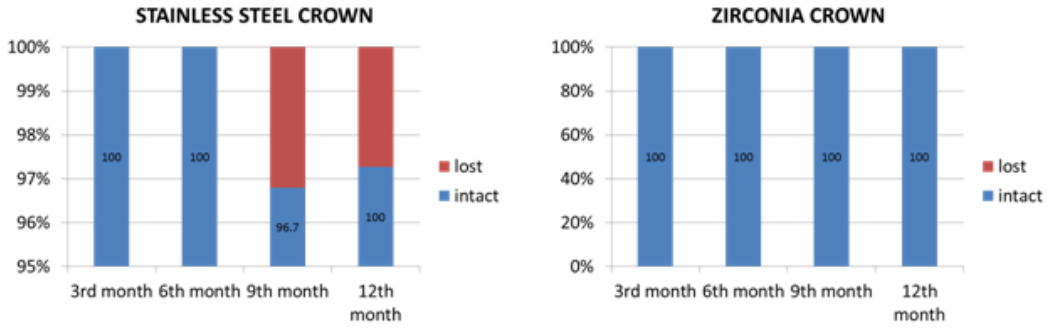
CROWN RETENTION



GRAPH 2: COMPARISON OF CROWN RETENTION OF STAINLESS STEEL AND ZIRCONIA CROWN

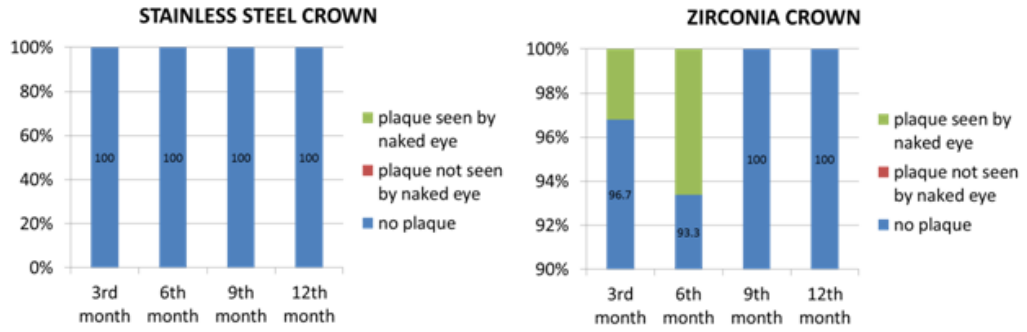


GRAPH 3: COMPARISON OF OPPOSING TOOTH WEAR CAUSED BY STAINLESS STEEL AND ZIRCONIA CROWN



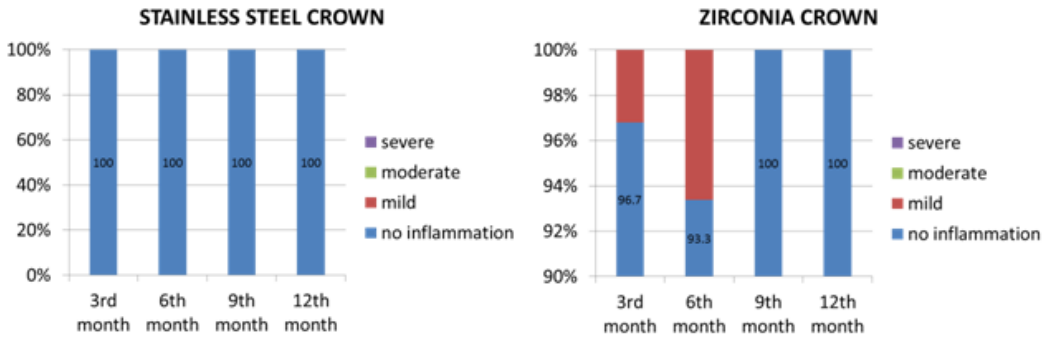
GRAPH 4: COMPARISON OF PROXIMAL CONTACT WITH STAINLESS STEEL AND ZIRCONIA CROWN

PLAQUE ACCUMULATION



GRAPH 5: COMPARISON OF PLAQUE ACCUMULATION WITH STAINLESS STEEL AND ZIRCONIA CROWN

GINGIVAL INFLAMMATION



GRAPH 6 : COMPARISON OF GINGIVAL INFLAMMATION WITH STAINLESS STEEL AND ZIRCONIA CROWN

Discussion

DISCUSSION

Full coronal restorations have become the prevalent part of rehabilitation of the children affected with early childhood caries. Multiple options have been tried with each one showing varied clinical performance. Change in life style, more opportunities to socialize and role of media plays a role in exposing the children to a concept of ideal beauty at very young age. This has showed impact on their concerns about esthetics which is similar to that of adults[8]. The same principle applies in terms of restorations to be placed on their teeth[9].

With the concept of esthetics gaining interest among parents and children, preformed zirconia crowns were becoming much more popular[15,27]. But very limited literature is available regarding their performance. Keeping the above fact in mind the present study was conducted to assess and compare the clinical performance and parental satisfaction of pediatric zirconia crowns with that of stainless steel crowns which were the most commonly used crowns for posterior primary teeth[5,19].

In this study a total of 70 crowns (35 zirconia and 35 stainless steel) were placed in 29 patients following pulp therapy. Of which 61crowns were available for 12 months follow up (31 SSC and 30 Zirconia crowns). The clinical evaluation criteria was similar to the one used by Holsinger et al. and Abdulhadi et al. The parental satisfaction of the crowns were obtained through

a survey with a set of dichomotous 'Yes/No' questions and 5 point likert type scale adopted from other studies[12,18,27].

In this study preformed Kinder krowns were used due to the availability of varied sizes, better retentive features and a polished surface to reduce opposing tooth wear. According to the manufacturers guidelines, resin modified glass ionomer (3M ESPE Rely X) was used to lute the crowns. Preformed Stainless Steel Crowns were luted with type 1 GIC (GC Type 1 GIC) as it is the most commonly recommended cement for luting stainless steel crowns[38].

The present study showed 96.7% (30/31) retention with stainless steel crown. Loss of stainless steel crown 3.2% (1) during 9th month follow up could be attributed to loss of cement. Micro structural porosity or the voids in the set cement can progressively cause crack propagation due to occlusal forces finally leading to cement loss over a period of time[39]. This could be the attributing factor for crown dislodgement at the end of 9th month review. The crown was re-cemented and reviewed till end and it was found to be intact. 93.77% (29/31) of zirconia showed complete retention of crowns. 3.2% (1) of zirconia crowns showed chipping of the crown and 3.2% (1) showed complete loss of crown at 3rd month follow up. The chipping of the crown could be attributed to the occlusal forces delivered while seating the crown or due to mild occlusal disharmony as a result of inability to trim the cuspal patterns of these crowns. The complete loss of crown in zirconia group could be as a

result of inadequate tooth structure to achieve subgingival preparation, functional cusp of opposing tooth due to inadequate moisture control while cementing or due to loss of cement. The crown which showed complete loss was recorded as restoration failure and it was replaced by custom made zirconia crown and not assessed for other parameters. These results are contrary to the findings of Abdulhadi et al who showed 100% retention of zirconia crowns. The cements used in the present study to lute the crowns were different and that might have influenced the bond strength which in turn could have influenced the retention of the crowns[4,7,24].

The crowns other than those which showed retention failure had good marginal integrity in both the groups (100% (31/31) with SSC and 96.6% (29/30) with zirconia crowns which was higher than that of Holsinger et al[15]. who showed 86% closed margins with zirconia crowns. This could be attributed to the morphological qualities of Kinder krowns. The fine feather margins could have contributed in good adaptation of crown to the tooth structure irrespective of excessive tooth preparation. Stainless steel crowns are easy to contour and crimp, making them adapt well to the prepared tooth structure.

100 % success rate with respect to proximal contact in both the groups was made possible because of the availability of varied sizes and morphological features as close as possible to that of natural teeth making them easier to establish proximal contact. The adjacent teeth were also intact

till the end of study period without any pathology. These results were similar to that of Abdulhadi et al[7].

All the stainless steel crowns evaluated for gingival inflammation and plaque accumulation showed healthy gingiva without any inflammation, whereas two children showed visible plaque accumulation and mild gingival inflammation in the zirconia group which was resolved during 9th month review. Gingival inflammation can be attributed to the generalized plaque accumulation and lack of motivation which was improved with oral prophylaxis and oral health education and motivation. Results showed that gingival health was better in teeth restored with stainless steel crowns than those which treated with zirconia crowns during 3 and 6 months follow-up. Reversal of the condition was observed at the end of 9th month review which was achieved through oral prophylaxis and oral hygiene education. Our results were contrary to the findings of Abduhadi et al who showed better gingival health with zirconia crowns (100%) when compared to stainless steel (75%). He stated that shaping of metal borders improperly as well as adhesive residues in the sulcus is the reason for gingival problems in case of stainless steel crowns, whereas glazed and polished surface of the zirconia crowns resulted in less plaque accumulation and good gingival health.

Both the groups showed no opposing tooth wear. This was contrary to the findings of studies Walia et al[4]. Donovon et al suggested opposing tooth wear occurs if the crown surface is improperly glazed[40]. In the present study,

Kinder krown were used which were manufactured based on nano technology with highly polished occlusal surface, resulting in no occlusal wear of opposing tooth. Till date no case of opposing tooth wear has been reported with stainless steel crowns because of its ability to adapt to the occlusal forces.

The results of this study suggests that both pediatric posterior zirconia crowns and stainless steel crowns maintained good proximal contact, marginal integrity with no opposing tooth wear. The results highlight the role of oral hygiene maintenance and health education on the gingival health with respect to crowns. The results also indicate the necessity of acquiring skills in preparing and placing the crowns to achieve best performance of the crowns.

Parental satisfaction obtained with a 5-point likert scale and an 'Yes/No' question revealed good satisfaction with respect to size and shape of both the crowns with better results with zirconia crowns (4.8 MEAN SCORE). The values were slightly higher than the findings of Holsinger et al.(4.4)[15]. With respect to colour, zirconia out performed stainless steel (2.9) with a mean score of 5. Both zirconia and stainless steel crowns performed similar with respect to parents perception of durability with a mean score of 4.8 which was slightly higher than the values obtained by Walia et al(4.7)[4]. Overall satisfaction with zirconia crown (4.8) was better than the stainless steel crowns (4.2). Impact of both the crowns on oral health and appearance (4.8) were slightly higher than the results of Holsinger et al (4.7)[15]. Problems experienced by the children after the crowns were none, except for 8% of the

zirconia crowns who reported bleeding around the crowns. Over all plaque accumulation could be the reason for poor gingival health which was improved with oral prophylaxis and oral health education.

All the parents were ready to opt zirconia crowns (100%), whereas only 60% accepted to opt for stainless steel crowns. Most of the parents were satisfied with stainless steel crowns only in maxillary dentition, but with respect to mandibular molars they preferred esthetic zirconia crowns.

Limitations of the study were inability to follow split mouth design with only one year follow-up. Further studies are recommended following a split mouth design, testing different brands of commercially available zirconia crowns with varied level of polish, gloss and morphological variations for a longer duration to get more valuable information on the clinical performance of preformed zirconia crowns. Further studies are recommended to test the crowns efficiency in varied clinical scenarios, such as crowded dentition, dentition with occlusal variation and placement of multiple crowns.

Both stainless steel crowns and zirconia crowns are an excellent choice for posterior primary teeth as their clinical performance and parental satisfaction was high. However stainless steel crowns performed better in terms of retention. But zirconia crowns can be the choice of post endodontic restoration when esthetics is of prime concern.

Conclusion

CONCLUSION

The following conclusions were drawn from the present study:

1. Pediatric zirconia (93.5%) and stainless steel crowns (96.7%) showed good clinical success rate with no significant difference between the two groups (p=0.317).
2. Crown retention, marginal integrity, accumulation of plaque and gingival health were better with stainless steel crown compared to zirconia crowns but not to the significant level (p=1.000).
3. Both stainless steel crowns and zirconia crowns showed no opposing tooth wear and established good proximal contact through-out the study period.
4. Parental satisfaction was significantly higher with zirconia (96%) crowns compared with stainless steel crowns (78%) primarily because of the colour (p=0.03).
5. Significantly greater number of parents prefer to recommend zirconia crowns (100%) than stainless steel crowns (60%).(p=0.021).

Clinical performance of zirconia and stainless steel crowns was good. The choice of the crowns during treatment plan can be made specific to each child based on the demands of the parents and the clinical scenario.

Summary

SUMMARY

Early childhood caries is one of the most common diseases of the oral cavity affecting very young children. Rehabilitation of the dentition is mandatory as the disease affects esthetics, function as well as phonation. Full coronal restorations have been the treatment option for management of early childhood caries. Preformed stainless steel crowns were the widely practiced full coverage restorations but were unable to fulfill the demand of esthetics which led to the invention of open faced stainless steel crown, preveneered stainless steel crown, polycarbonate crowns, composite strip crowns and recently preformed zirconia crowns.

Literature evidence on performance of preformed zirconia crown in primary dentition is sparse. The current study was done to clinically evaluate and compare preformed zirconia crown and stainless steel crown on posterior primary teeth in Seventy primary molars of twenty nine children aged between 3-9yrs. Parental satisfaction, problems encountered by the child after crown placement and future treatment options were elicited from twenty five parents with a questionnaire adopted from study conducted by Walia et al and Holsinger et al. Mann-whitney U test and Wilcoxan rank test were used for statistical analysis.

The 12th month follow-up results showed no opposing tooth wear and intact proximal contact in both the groups. No plaque accumulation with good gingival health was observed at 12th month review (100%). But 3rd and 6th month follow –up suggested visible plaque accumulation and mild gingival inflammation (93.5%) with zirconia crowns which resolved with oral prophylaxis and oral hygiene education. The crown retention and marginal integrity with zirconia crown was 93.5% whereas stainless steel crowns showed 100% crown retention at the end of 12 months.

Zirconia crowns showed 93.5% overall success rate whereas stainless steel crowns showed 96.7% success rate, with no significant difference between the groups.

Most of the parents were satisfied with both the crowns (78% stainless steel crowns and 100% zirconia crowns). 8% reported bleeding around zirconia crowns whereas no problems were associated with stainless steel crowns. 60% of stainless steel group and 100% of zirconia group parents were opting the respective crowns in the future .

Posterior preformed zirconia crowns perform at par with that of stainless steel crowns and have proved the preference of esthetics among parents. Thus posterior preformed zirconia crowns can be opted when esthetics is of primary concern.

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Annexures

ANNEXURE-1

RAGAS DENTAL COLLEGE & HOSPITAL
(Unit of Ragas Educational Society)
Recognized by the Dental Council of India, New Delhi
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TO WHOM SO EVER IT MAY CONCERN

Date: 28.12.2018

Place: Chennai

From
The Institutional Review Board,
Ragas Dental College,
Uthandi,
Chennai-600119

The dissertation topic titled **"CLINICAL EVALUATION AND PARENTAL SATISFACTION WITH PEDIATRIC POSTERIOR STAINLESS STEEL CROWNS AND ZIRCONIA CROWNS – A COMPARITIVE STUDY"** submitted by **Dr.GAYATHRI M** has been approved by Institutional Ethics Board of Ragas Dental College and Hospital.

Dr.N.S.AZHAGARASAN, MDS.,
Member Secretary,
Institutional Ethics Board,
Ragas Dental College & Hospital,
Uthandi,
Chennai-600119

ANNEXURE-2

MASTER CHART-3month

S.No	Crown Type	Crown Retention	Proximal Contact	Marginal Intergrity	Opposing Tooth Wear	Gingival Inflammation	Plaque Score
1	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
2	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
3	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
4	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
5	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
6	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
7	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
8	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
9	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
10	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
11	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
12	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
13	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
14	Zirconia	Intact	Intact	Closed	No wear	Mild inflammation	Plaque present
15	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
16	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
17	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
18	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
19	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
20	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
21	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
22	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
23	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
24	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
25	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
26	Zirconia	Chipping	Intact	open	No wear	No inflammation	No plaque
27	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
28	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
29	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
30	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
31	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque

MASTER CHART-6 months

S. NO	Crown Type	Crown Retention	Proximal Contact	Marginal Intergrity	Opposing Tooth Wear	Gingival Inflammation	Plaque Score
1	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
2	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
3	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
4	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
5	Zirconia	Complete loss	Intact	Open	No wear	No inflammation	No plaque
6	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
7	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
8	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
9	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
10	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
11	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
12	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
13	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
14	Zirconia	Intact	Intact	Closed	No wear	Mild inflammation	Plaque present
15	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
16	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
17	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
18	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
19	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
20	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
21	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
22	Zirconia	Not app	Not app	Not app	Not app	Not app	Not app
23	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
24	Zirconia	Intact	Intact	Closed	No wear	Mild inflammation	Plaque present
25	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
26	Zirconia	Chipping	Intact	Closed	No wear	No inflammation	No plaque
27	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
28	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
29	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
30	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
31	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque

MASTER CHART-9 months

S.No	Crown Type	Crown Retention	Proximal Contact	Marginal Intergrity	Opposing Tooth Wear	Gingival Inflammation	Plaque Score
1	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
2	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
3	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
4	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
5	Zirconia	-	-	-	-	-	-
6	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
7	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
8	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
9	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
10	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
11	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
12	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
13	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
14	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
15	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
16	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
17	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
18	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
19	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
20	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
21	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
22	Zirconia	Not app	Not app	Not app	Not app	Not app	Not app
23	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
24	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
25	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
26	Zirconia	chipping	Intact	Open	No wear	No inflammation	No plaque
27	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
28	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
29	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
30	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
31	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque

MASTER CHART-12 months

S.No	Crown Type	Crown Retention	Proximal Contact	Marginal Intergrity	Opposing Tooth Wear	Gingival Inflammation	Plaque Score
1	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
2	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
3	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
4	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
5	Zirconia	-	-	-	-	-	-
6	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
7	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
8	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
9	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
10	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
11	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
12	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
13	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
14	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
15	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
16	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
17	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
18	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
19	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
20	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
21	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
22	Zirconia	Intact	Intact	Not app	Not app	Not app	Not app
23	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
24	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
25	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
26	Zirconia	Chipping	Intact	Closed	No wear	No inflammation	No plaque
27	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
28	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
29	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
30	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque
31	Zirconia	Intact	Intact	Closed	No wear	No inflammation	No plaque

ANNEXURE -3

MASTER CHART-3month

S.No	Crown Type	Crown Retention	Proximal Contact	Marginal Intergrity	Opposing Tooth Wear	Gingival Inflammation	Plaque Score
1	SSC	Intact	Intact	Closed	No wear	mild inflammation	No plaque
2	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
3	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
4	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
5	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
6	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
7	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
8	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
9	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
10	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
11	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
12	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
13	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
14	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
15	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
16	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
17	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
18	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
19	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
20	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
21	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
22	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
23	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
24	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
25	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
26	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
27	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
28	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
29	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
30	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
31	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque

MASTER CHART-6month

S.No	Crown Type	Crown Retention	Proximal Contact	Marginal Intergrity	Opposing Tooth Wear	Gingival Inflammation	Plaque Score
1	SSC	Intact	Intact	Closed	No wear	mild inflammation	No plaque
2	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
3	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
4	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
5	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
6	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
7	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
8	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
9	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
10	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
11	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
12	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
13	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
14	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
15	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
16	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
17	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
18	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
19	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
20	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
21	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
22	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
23	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
24	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
25	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
26	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
27	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
28	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
29	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
30	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
31	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque

MASTER CHART-9month

S.No	Crown Type	Crown Retention	Proximal Contact	Marginal Intergrity	Opposing Tooth Wear	Gingival Inflammation	Plaque Score
1	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
2	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
3	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
4	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
5	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
6	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
7	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
8	SSC	Lost	Not app	Open	No wear	No inflammation	No plaque
9	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
10	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
11	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
12	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
13	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
14	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
15	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
16	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
17	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
18	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
19	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
20	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
21	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
22	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
23	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
24	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
25	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
26	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
27	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
28	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
29	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
30	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
31	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque

MASTER CHART-12month

S.No	Crown Type	Crown Retention	Proximal Contact	Marginal Intergrity	Opposing Tooth Wear	Gingival Inflammation	Plaque Score
1	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
2	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
3	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
4	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
5	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
6	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
7	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
8	SSC	Lost	No app	Open	No wear	No inflammation	No plaque
9	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
10	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
11	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
12	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
13	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
14	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
15	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
16	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
17	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
18	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
19	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
20	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
21	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
22	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
23	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
24	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
25	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
26	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
27	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
28	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
29	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
30	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque
31	SSC	Intact	Intact	Closed	No wear	No inflammation	No plaque

ANNEXURE -4

CONSENT FORM

I_____, the parent/guardian of_____, hereby give consent for the participation of myson/daughter in the study titled **"CLINICAL EVALUATION AND PARENTAL SATISFACTION WITH PEDIATRIC STAINLESS STEEL CROWNS AND ZIRCONIA POSTERIOR CROWNS- A COMPARATIVE STUDY** being conducted by **M.GAYATHRI**, a postgraduate student of Ragas Dental College and Hospital, Chennai, under the guidance of **Dr.M.JAYANTHI,** Prof and Head, department of pedodontics and preventive dentistry. I have been clearly informed about the procedure/techniques of the study and I voluntarily, unconditionally, freely give my consent for the active participation of my child without any form of pressure and in a mentally and conscious state.

Signature of the investigating doctor

Signature of the Patient's parent/ Guardian.

ANNEXTURE-5

URKUND

Urkund Analysis Result

Analysed Document: plagarism check.docx (D46405704)
Submitted: 1/4/2019 9:28:00 AM
Submitted By: drgayathrimurali1992@gmail.com
Significance: 4 %

Sources included in the report:

Thesis copy.docx (D46274066)
http://www.jpediatrdent.org/article.asp?issn=2321-6646;year=2017;volume=5;issue=1;spage=21;epage=27;aulast=Abdulhadi

Instances where selected sources appear:

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